DOCUMENT RESUME

ED 063 972 PS 005 496

AUTHOR Higgins-Trenk, Ann; Gaite, A. J. H.
TITLE The Elusiveness of Formal Operational Thought in Adolescents.
PUB DATE 4 Sep 71
NOTE 8p.; Paper presented at the 79th Annual Convention of the American Psychological Association, Washington, D.C., September 4, 1971

EDRS PRICE MF-$0.65 HC-$3.29
DESCRIPTORS *Abstraction Tests; Adolescents; *Cognitive Development; Cognitive Objectives; Comparative Analysis; *Conservation (Concept); Descriptive Writing; Experimental Psychology; High School Students; *Hypothesis Testing; Sex Differences; Simulation; *Task Analysis; Thought Processes
IDENTIFIERS *Piaget (Jean)

ABSTRACT

To compare the adolescent's mode of thinking on one specific measure of cognition, conservation of volume, with his mode of thinking on a task simulating a familiar real-life situation, a study was made using 162 students (76 males and 86 females, 13.4 to 17.7 years of age, grades 7,8,9,10,12). The students, grouped according to age into four groups, were tested first on an open-ended situational dilemma using three situations with three levels on a closeness-to-self dimension. The students' written responses were judged according to the extent to which they met criteria for abstract thinking. A second test, Elkind's replication of Piaget's conservation of mass, weight and volume tasks, was administered one week later to test conservation of volume. The successful completion of the test was considered as evidence of the ability to think at the formal operational level. Test data were analyzed using contingency tables and the Chi-square method. Results indicated the following: (1) successful completion of the conservation task and a high rating on the situation task were independent; (2) there was a significant positive relationship between the mean age of each of the four groups and the number using abstract thinking, with the older groups scoring higher on the situation task; (3) there was no significant positive trend between mean age and successful completion of the Piagetian task; (4) collapsed cross-age groups and analyzed by sex, more females than males used abstract thinking on the situation task, with the opposite being true on the conservation task; and (5) no trend was found in the use of abstract thinking among conservers on the three levels of closeness-to-self. (LS)

U.S. DEPARTMENT OF HEALTH,
EDUCATION & WELFARE
OFFICE OF EDUCATION
THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL OFFICE OF EDUCATION POSITION OR POLICY.

ED 063972

The Elusiveness of Formal Operational Thought in Adolescents

Ann Higgins-Trenk and A.J.H. Gaite
Department of Educational Psychology
University of Wisconsin

PS 005496

While the general topic of cognitive development has been a popular area of investigation for researchers, it is true to say that the more specific topic of adolescent cognitive development has been relatively neglected. Most writers and reviewers (e.g., Ausubel & Ausubel, 1966; Stone & Church, 1968) when considering cognitive development have tended to accept tacitly Piaget's descriptions of intellectual development and have been content to describe the adolescent as typically attaining the formal operational stage of thought during early adolescence; and then to leave the reader with the distinct impression that such adolescents thereafter habitually function at that level. However, the work of Elkind (1961) and Perry (1968) suggests that this view of the typical adolescent's thought processes and intellectual functioning might be too simplistic. This over-simplification arises from the tendency for most studies of intellectual functioning of older children, adolescents, and college-age persons to deal with specific, isolated kinds of cognitive abilities (e.g., Piagetian tasks and memory tasks). Formal operational thought is complex, dynamic, difficult-to-operationalize concept. Abstraction, organization, and recognition of possibility, probability, and relativity have been assumed to be necessary underlying abilities for successful completion of specific Piagetian tasks that have been used as indices of formal operational thought (Inhelder and Piaget, 1958). While this research has increased our knowledge of cognition, little research has been done that

This paper was presented at the meeting of the American Psychological Association, Washington D.C. on September 4, 1971.

attempts to ascertain whether the adolescent uses these same cognitive abilities when confronting real-life day-to-day situations.

The present study was designed to compare the adolescent's mode of thinking on one specific measure of cognition, conservation of volume, with his mode of thinking on a task simulating a familiar real-life situation. To simulate real-life is a bold undertaking, as the authors realize; however, such an attempt can be justified by the lack of substantive evidence that, indeed, formal operational thought is typical of normal thought in adolescents and adults. Specifically this study tested the following hypotheses: (1) That adolescents who score high on abstract thinking on the situation task will successfully complete the conservation of volume task. It was postulated that this positive relationship should exist across all ages and across sexes: (2) That adolescents who display the use of formal operational thought by successful completion of the Piagetian task will vary in their use of abstract thinking on the situation task, according to the position of the situation on the closeness-to-self dimension. Adolescents writing about a situation bearing upon themselves give little evidence of using abstract thinking; adolescents writing about a situation involving an unknown student give the most evidence of using abstract thinking; and those writing about their best friend give only some evidence of using abstract thinking. Furthermore, it is hoped that this study has provided useful additional data concerning the intellectual functioning of adolescents between the ages of 13 and 18 years.

Method

Subjects

The subjects were 162 normal junior and senior high students (76 males and 86 females) from a Wisconsin high school. The subjects were divided into

4 groups: Group 1 - 40 subjects, mean age 13.4 years: Group 2 - 53 subjects, mean age 14.9 years: Group 3 - 38 subjects, mean age 15.7 years: Group 4 - 31 subjects, mean age 17.7 years. The subjects were drawn from grades 7,8,9 10, and 12.

Design and Procedure

Throughout the study the experimenters worked with the subjects in groups. Subjects were first given an open-ended situational dilemma to which they responded by writing down their solutions to the problem or situation and their reasons for them. Three different situations were used, each group receiving the problem judged by the experimenters as being most real and familiar to them. One situation asked for the subject's response to a request to aid a classmate in cheating on a test. Each of the three situations had three levels on a closeness-to-self dimension. They were: (a) Directly relating the subject, using the pronoun "you" throughout the text of the dilemma; (b) Close to the subject, using the term "your best friend"; (c) Removed from the subject, using the term "a student". In each of the four experimental groups subjects were randomly assigned to one level on the closeness-to-self dimension. Two judges read the subjects' responses to the situations and rated them according to the extent that they met criteria for abstract thinking. The criteria used were: (a) The ability to see reality as a subset within the totality of all possibilities; (b) The ability to imagine all possibilities of a situation; (c) The ability to search for a solution in a situation from any of these perspectives. (d) The ability to come to logical conclusions about a situation through thinking without having previously met the situation in reality. Each subject's response was assigned a score from 1 to 4 on an ordered scale, 1 rep-

resenting no use of abstract thinking and 4 representing convincing use of abstract thinking. The judges were given practice in rating the responses to insure understanding of interpretation of the criteria. The two judges agreed on their ratings in 73% of the 162 cases. The gamma statistic, a measure of association in ordered classes was computed as an index of inter-judge agreement (γ=.91). In only 3 cases did the judges assign ratings that disagreed by more than 1 point on the 1 to 4 scale; these were dropped from the study, leaving a sample of 159 subjects for further analysis. On 26% of the cases the judges' ratings disagreed by only 1 point; in order to assign a number score to these cases a coin was tossed, one judge's score randomly being assigned heads or tails and the winning score assigned. This was necessary as results on this task were later compared with those on the second task.

One week later, the subjects were given a task following the format of Elkind's (1961) replication of Piaget's conservation of mass, weight and volume tasks. Successful completion of the conservation of volume task was taken as evidence of a subject's ability for thinking at the formal operational level, as conservation of volume has been delineated by Elkind (1961) as being indicative of the onset of formal operational thought. The task involved the use of identical clay balls, which were presented by the experimenters to the subjects, who then wrote answers to the series of questions developed by Elkind (1961). A subject had to answer successfully all questions to be judged as completing the task and thus a conserver. A third judge rated the answers on this task.

Results

The data were analyzed using contingency tables and the Chi-square method. Tables were set up to look at the following interactions: (a) Between attainment of the concept of volume conservation on the Piagetian task and the use of abstract thinking on the situation task; (b) Between age (using mean ages) and the situation and conservation tasks; (c) Between sex and the situation and conservation tasks; (d) Between the three levels on the closeness-to-self dimension and the situation and conservation tasks.

The data indicated the following: (1) Successful completion of the conservation task and a high rating, evidence of the use of abstract thinking, on the situation task were independent. The observed and expected values in the contingency tables made it clear that the null hypothesis of independence could not be rejected ($X^2=1.65, df=3$, ns). (2) There was a significant positive relationship between the mean age of each of the four groups and the number of subjects using abstract thinking (the older groups scored higher) on the situation task ($X^2=63.26, df=9, p<.001$). (3) There was no significant positive trend between mean age and successful completion of the Piagetian task ($X^2=5.92, df=3$, ns). (4) Collapsed across age groups and analyzed by sex, significantly more females than males used abstract thinking on the situation task ($X^2=10.18, df=3, p<.025$). On the conservation task analysis by sex revealed the opposite finding, significantly more males than females were volume conservers ($X^2=1.71, df=1, p<.10$), a finding consistent with that of Elkind (1961). (5) The expected trend in use of abstract thinking among conservers on the three levels of the closeness-to-self dimension was not found ($X^2=6.15, df=6$, ns). The age trend, that older adolescents showed greater evidence of using abstract thinking, was significant for each of the three

PS 005496

levels on the closeness-to-self dimension ("you"-X^2=24.75,df=9,p<.005; "your best friend" - X^2=23.93,df=9,p<.005; "a student" - X^2=28.67,df=9,p<.001). (6) Only 18% of the adolescents were both conservers and showed evidence of the use of abstract thinking (i.e., ranked 3 or 4 on the situation task). Nearly half of the sample (45%) were conservers, and 38% showed evidence of using abstract thinking when they wrote about a situation relevant to them.

Discussion

The independence of the two indices of evidence of formal operational thought points out the difficulty of finding specific tasks to use as the defining criteria for this complex and dynamic concept. If formal operational thought is interpreted in terms of success at some Piagetian task or by assessing the subjects' responses to a relevant situation or dilemma, then relatively few adolescents seem capable, or inclined, to use this mode of thought. This suggests that there is need for considerable revision of the commonly held view that the normal adolescent attains and uses the level of formal operations soon after pubescence.

One explanation for the results that only 38% of the subjects met the criteria for abstract thinking on the situation task, might lie within the idea of adolescent egocentrism. If indeed, as many psychologists claim, adolescence is a time of intense self-examination and self-awareness, then it might very likely be emotionally impossible, or at least an emotional strain, for these persons to deal with any hypothetical even though familiar and relevant situation in an abstract, intellectual manner. It might even be the case that the 55% of the subjects who were unable to demonstrate knowledge of volume conservation were unable to do so because emotionally they

were unwilling to give their attention to a seemingly irrelevant and unrewarding task for the class period necessary.

One can go even further and question whether such tasks, specifically those used in Elkind's (1961) and the present study, indeed, are indices of formal operational thought. Because females did significantly better on the situation task and males did significantly better on the conservation task, it seems likely that these tasks may not be evidence of formal operational thought but rather evidence of acculturation. It is well known that in American schools females typically do better on written tasks involving the ability to express and convey ideas, while males typically do better on spatial relations type tasks. Given this knowledge, the tasks used in this study may not have gone beneath what is taught in the school system to the intellectual functioning of the individuals in that system. In light of this interpretation, the use of abstract thinking would not be expected to vary along the closeness-to-self dimension, because the task failed to tap the individual's level of abstract thinking. The idea that persons operate more at the concrete level of thinking when dealing with situations bearing upon themselves and save their ability to think abstractly and at the formal operational level for those problems recognizable as theoretical, is an intriguing concept but more ingenious studies than this must be designed to test its validity in reality.

8-30-71
nn

References

Ausubel, D.P., and Ausubel, Pearl. Cognitive development in adolescence. Review of Educational Research, 1966, 36, 4, 403-413.

Elkind, D. Quantity conceptions in junior and senior high school students. Child Development, 1961, 32, 551-560.

Hays, W.L. Statistics for Psychologists. New York: Holt, Rinehart and Winston, 1963, 655-656.

Inhelder, B., and Piaget, J. The Growth of Logical Thinking from Childhood to Adolescence. New York: Basic Books, Inc., 1958.

Looft, W.R. Egocentrism and social interaction across the life span. Psychological Bulletin, 1972, in press.

Perry, W.G., Jr. Forms of Intellectual and Ethical Development in the College Years: A Scheme. New York: Holt, Rinehart and Winston, 1968.

Stone, L.J., and Church, J. Childhood and Adolescence. (2nd ed.) New York: Random House, 1968.